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The Dark Side of EU Mobility Growth

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Abstract:

Purpose: *The aim of the publication is to determine synthetic indicators for assessing the intensity of the adverse impacts of the transport sector in the EU Member States. The aim is therefore to fill a research gap by quantitatively assessing the aforementioned indicators across all EU Member States, thus enabling the identification of replicable patterns, national specificities and the degree of dispersion of negative transport impacts.*

Design/Methodology/Approach: *A multidimensional comparative analysis - Hwlwig's medel - was used to meet the objective, reflecting the possibility of developing a synthetic indicator combining three key dimensions of negative transport impacts. Secondary data from European monitoring (CO_2 emissions, transport energy consumption, road fatalities) were analysed, converted to per capita values and then aggregated into a single scale for assessing socio-environmental burden.*

Findings: *The indicator developed, which is synthetic in nature, shows differences between EU countries. The best results are achieved by Germany, Denmark, Estonia and Finland, among others, which simultaneously reduce emissions, manage energy rationally and maintain a high level of safety. The value of the index also indicates countries with an urgent need to modernise and reform their transport systems, such as Romania.*

Practical Implications: *The results of the survey can serve decision-makers as a tool to identify: (1) good management practices and (2) areas in need of financial and (3) legislative support. The proposed synthetic indicator facilitates comparing the effectiveness of transport policies and monitoring progress towards sustainability and sustainable mobility goals.*

Originality/Value: *The study fills a gap in the literature by integrating the environmental and social costs of transport into a single, comparative measure for all EU countries. Such a holistic view of the three main dimensions of transport impacts is rare and adds value to the design of integrated transport policies.*

Keywords: *Sustainable transport, SD, European Union, Competitiveness.*

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1. Introduction

Transport is considered to be the foundation of economies and social structures, spatial integration, and the mobility of people, goods, and services (Kozłowska, 2020, 69-72). Its strategic role in the development of industry, trade, and employment contributes to increased well-being and reduced social exclusion, while also being used as a tool for achieving broadly understood sustainable development goals (Małecka, 2023, p. 11-33; EESC, 2018; Miłaszewicz and Ostapowicz, 2011, p. 103-118).

However, the development of transport infrastructure is associated with negative environmental and health impacts, such as excessive greenhouse gas emissions, degradation of natural spaces, noise, and risks to public health, which require a comprehensive research approach (EC, 1992; 1998; 2021a; OECD, 2004; 1991; EP, 2019, 2023).

The aim of this publication is to determain synthetic indicators for assessing the intensity of the adverse impacts of the transport sector in the Member States of the European Union.

The aim is therefore to fill a research gap by quantitatively assessing these indicators in all EU Member States, which will enable the identification of recurring patterns, national specificities, and the degree of dispersion of the negative effects of transport.

This approach expands the existing literature with a comparative systemic analysis perspective, supporting both theoretical research and the practice of maintaining sustainable mobility.

Three key indicators were selected for analysis: energy intensity of the transport sector, greenhouse gas emissions, and the number of road accident fatalities per capita. These indicators were subjected to a multidimensional comparative analysis, enabling data aggregation using a synthetic measure that allows for the comparison of the level of burdens between individual EU countries (EC, 2001; 2011; 2021; 2024a; 2024b; EP, 2023b; 2024; 2025).

The results of the analysis allowed for the mapping of spatial differences in the sustainability of transport systems and the assessment of the effectiveness of public policies in the field of mobility. Both good practices – characterizing countries that achieve the best results in reducing emissions and energy consumption while maintaining a high level of safety – and areas requiring urgent reform were identified.

This approach makes it possible to formulate recommendations for decision-makers and to indicate further directions for research on the integration of environmental and social aspects into the European Union's transport strategies.

2. Literature Review

The literature on the subject emphasizes that a transport system is considered sustainable when it provides universal and safe access to transport services, supports economic growth, and at the same time respects the limits of environmental capacity in terms of absorbing emissions and reducing the consumption of non-renewable resources (OECD, 2004, p. 17; Grima *et al.,* 2025).

Therefore, the assessment of sustainability includes not only the implementation of low-emission technologies, but also an analysis of the social aspects of user safety, service accessibility, and intergenerational equity, as well as economic indicators of cost-effectiveness, infrastructure development, and sector competitiveness (Małecka, 2023, pp. 11-33; Kozłowska, 2020; Bartniczak, 2013, pp. 11-20; Noja *et al.,* 2021).

It should be emphasized that the European Union's transport policy has evolved from its beginnings, which focused on the creation of a common market for transport services through the harmonization of regulations and the removal of entry barriers, to today's model of sustainable mobility, which combines economic, social and environmental objectives (EC, 2023; 2021; 2011; 2001; 1998; 1992; EP, 2025; 2024; 2023a; 2023b; 2019). Currently, three main research trends are emphasized:

(1) sustainable mobility:
   a. promoting public transport, rail transport, and active transport (cycling, walking) as alternatives to individual transport (EC, 2021)
   b. modal shift and integration of different modes of transport to reduce emissions and improve air quality in cities (Krych, 2024, pp.3-16; Jarosz and Springer, 2021, p. 122-140)

(2) low- and zero-emission technologies
   a. development of electromobility and the hydrogen economy supported by EU regulations (EUandCEU 2023a; 2023b; 2023c) and funds (EC, 2024a; 2024b; De Fazio *et al.,* 2023)

b. implementation of intelligent energy recovery and traffic management systems that reduce fossil fuel consumption (Stecuła *et al.,* 2022; Doołęga, 2022, pp. 118-122)

(3) road safety

a. analyses of the effectiveness of legal and educational frameworks in reducing accident victims — from a more than 60% decrease in the number of victims between 2001 and 2020 to a 3.5% increase in 2022 (EC, 2024a; CEU, 2017)

b. New initiatives: the vision of "zero casualties" by 2050 (Council of the EU, 2017), the 2021-2030 strategic framework covering eCall, blood alcohol limits, and infrastructure audits (EC, 2021; EEA, 2024).

In addition, research often focuses on financing mechanisms and the evaluation of the effectiveness of local and regional policies (Harasimowicz, 2024; Kos *et al.,* 2022, pp. 84-117). However, there is insufficient literature integrating the three key indicators: the energy intensity of the sector, greenhouse gas emissions, and the number of accident victims (Thalassinos, 2024).

There is therefore a gap in the systemic analysis of these indicators as interrelated elements of the transport system. Therefore, this publication presents an approach that extends the existing literature with a comparative systemic analysis perspective, supporting both theoretical research and the practice of maintaining sustainable mobility.

3. Research Methodology

When examining the spatial diversity of transport development in the EU-27 countries, a linear ordering method was used, which is considered an effective tool for multidimensional comparative analysis (Balcerzar, 2015).

A synthetic indicator was constructed in accordance with the Hellwig model, aggregating three key dimensions: safety level, energy consumption, and greenhouse gas emissions (Hellwig, 1981). This indicator serves as a representative measure of sustainable transport development, enabling an objective assessment and ranking of all EU-27 member states.

The selection of diagnostic variables was based on their ability to identify determinants enabling sustainable development in the aspect under study. In other words, both the barriers limiting sustainable transport development and the evident advantages in implementing sustainable development in the countries studied were analyzed.

The selected indicators were then standardized to bring them to a common reference scale, and their aggregation was carried out using a precisely constructed weighting function (Bąk, 2018, pp. 7-20; Broniewicz and Ogrodnik, 2021).

Thanks to the harmonization of metrics and the balanced selection of weights, the resulting synthetic indicator reflects the multidimensional nature of transport development in the EU-27, taking into account complex socio-economic and environmental conditions (Table 1).

The application of the Hellwig method required the construction of an observation matrix X, consisting of n rows (EU countries) and m columns (diagnostic features) (formula 1):

$$X = \begin{bmatrix} x_{11} & x_{12} & \cdots & x_{1m} \\ x_{21} & x_{22} & \cdots & x_{2m} \\ \vdots & \vdots & \vdots & \vdots \\ x_{n1} & x_{n2} & \cdots & x_{nm} \end{bmatrix} \tag{1}$$

Table 1. *Preliminary list of diagnostic features of sustainable transport development in EU countries*

No.	Indicator Name	Indicator Description
X1	Final energy consumption indicator in transport	• Definition: measures the final energy consumption of domestic transport modes (road, rail, domestic aviation, inland waterways) • Exclusions: international maritime and aviation transport (not included in final consumption) • Unit: million tons of oil equivalent (Mtoe) • Purpose: • assessing the transport sector's share of total energy consumption • international and interregional comparisons • monitoring energy efficiency and progress in sustainable development • Analytical applications: energy efficiency, climate policy, emission reduction, sustainable development strategies
X2	Greenhouse gas emissions indicator in the transport sector	• Definition: measures total greenhouse gas emissions generated by domestic transport (road, rail, domestic aviation, inland waterways) • Exclusions: international maritime and aviation transport (not included in the methodology) • Unit: millions of tons of CO_2 equivalent (CO_2e) • Purpose: • assessing the impact of the transport sector on climate change • monitoring progress in reducing greenhouse gas emissions • international and interregional comparisons • Analytical applications: effectiveness of reduction measures, implementation of climate policies, sustainable development strategies

X3	Road accident fatality rate	• Definition: number of fatalities in road transport within the EU in a given year (30-day period from the accident) • Exclusions: rail and air transport (due to the marginal number of fatalities compared to road transport) • Reference value (2023): 20,653 fatalities • Objective: • monitoring road safety levels • identifying areas requiring intervention • assessing the effectiveness of transport policies in terms of sustainable development • Analytical applications: setting priorities for preventive measures, evaluating safety improvement programs, comparisons between countries and regions

Source: *Own study, based on EC, 2021a; 2023; 2024a; 2024b; EEA, 2024;*

Next, based on the preliminary list of indicators, a final set of diagnostic variables was created that demonstrate adequate differentiation. The variability of these variables was determined using the classic coefficient of variation (formulas 2 and 3), based on standard deviation, which is a measure of statistical population (formula 4):

$$V_j = \frac{S_j}{\bar{x}_j} \quad (2)$$

$$\bar{x}_j = \frac{\sum_{i=1}^{n} x_{ij}}{n} \quad (3)$$

$$S_j = \sqrt{n^{-1}\sum_{i=1}^{n}(x_{ij} - \bar{x}_j)^2} \quad (4)$$

where:
V_j – coefficient of variation of the variable
S_j – standard deviation of the variable
$\bar{x}_j$ – arithmetic mean of the variable
x_{ij} – the value of the j-th feature in the i-th territorial unit
n – the number of regions in the EU (n=27)

It was assumed that indicators with a classic coefficient of variation (determined on the basis of standard deviations) below 0.10 do not meet the diagnostic criteria. Nevertheless, in the context of assessing the negative impacts of the transport sector, all measures of greenhouse gas emissions, energy consumption, and the number of road accidents, despite their varying variability, were considered relevant and included in further analyses.

The final set of variables formed the basis for the construction of a synthetic indicator of the negative consequences of mobility development, allowing the EU-27 regions to be categorized according to their degree of burden.

Next, a procedure for normalizing the diagnostic variables was carried out, consisting of converting the raw values to a common reference scale. Normalization was carried out to ensure data comparability and an objective assessment of the level of environmental and social pressure caused by the transport sector (Grabiński, Wydymus and Zrliaś, 1989).

After normalizing the diagnostic variables, the next stage was carried out, where a linear ordering method based on the so-called development pattern method was applied. A model reference object was assumed, i.e., a theoretical standard against which the taxonomic distances of the analyzed European Union countries were determined.

Euclidean metrics were used to measure these distances, allowing for the determination of the degree of similarity or difference between countries in terms of the negative effects of transport development. The synthetic development index, expressing the level of environmental and social burdens associated with mobility, was calculated as the taxonomic distance of each country from the theoretical model, according to the following formula:

$$M_i = 1 - \frac{d_{i0}}{d_0} \; (I = 1, 2, \ldots, n) \quad (5)$$

where:
M_i – synthetic meter
d_{i0} – Euclidean distance of each pattern to build
m – number of variables
n – number of countries
z_{ij} – standardized value of output features (variable for regions)
z_{0j} – normalized value of the pattern for the variable
$\bar{d}_0$ – arithmetic mean of the taxometric distances
S_0 – standard deviations of the taxonomic distance

where:

$$d_{i0} = \sqrt{\sum_{j=1}^{m} (z_{ij} - z_{0j})^2} \; (i = 1, 2, \ldots, n; j = 1, 2, \ldots m) \quad d_0 = \bar{d}_0 + 2S_0 \quad \bar{d}_0 = n^{-1} \sum_{i=1}^{n} d_{i0} \quad S_0 = \sqrt{n^{-1} \sum_{i=1}^{n} (d_{ij} - d_0)^2}$$

The final stage of the study involved ranking the European Union member states and grouping them using the k-means method. This division was based on the value of a synthetic indicator, by initially dividing the set into two groups – countries with values above and below the average. In subsequent steps, partial averages were used for each group, which allowed for further refinement of the classification.

4. Research Results

The study included taxonomic calculations aimed at determining synthetic indicators for assessing the intensity of adverse impacts of the transport sector in European Union member states. The analysis was based on three key dimensions – agreenhouse gas emissions, energy consumption, and the number of road traffic fatalities – considered representative of the environmental and social consequences of mobility development.

The normalized data were used to compile a set of statistical characteristics of diagnostic variables that illustrate the spatial variation in the level of the effects studied in EU countries. The results obtained form the basis for further classification and comparison (Table 2).

Table 2. *Statistical characteristics of diagnostic variables and statistical measures of the negative effects of transport in EU countries*

Country	Value of diagnostic variables			Standardized values of diagnostic variables			Euclidean Distance	Synthetic meter M
	X1	X2	X3	Z1	Z2	Z3		
Belgium	0.74	4.62	45.99	-0.13	-0.53	0.12	2.24	0.5498
Bulgaria	0.54	1.67	82.35	0.44	0.53	-2.21	3.92	0.2104
Czechia	0.64	1.87	48.67	0.15	0.46	-0.05	1.90	0.6185
Denmark	0.67	2.66	25.96	0.06	0.18	1.41	1.01	0.7961
Germany	0.60	2.13	33.05	0.27	0.36	0.95	1.01	0.7963
Estonia	0.62	2.76	35.87	0.21	0.14	0.77	1.27	0.7447
Ireland	0.76	2.88	29.40	-0.18	0.10	1.19	1.32	0.7346
Greece	0.56	2.73	62.80	0.37	0.15	-0.95	2.75	0.4467
Spain	0.68	2.78	36.31	0.05	0.13	0.74	1.38	0.7222
France	0.65	2.14	47.82	0.11	0.36	0.01	1.88	0.6222
Croatia	0.58	1.91	71.41	0.32	0.44	-1.51	3.25	0.3454
Italy	0.62	2.08	53.54	0.20	0.38	-0.36	2.18	0.5612
Cyprus	0.71	4.06	40.19	-0.05	-0.33	0.49	1.84	0.6304
Latvia	0.54	2.10	60.01	0.43	0.38	-0.78	2.53	0.4916
Lithuania	0.74	2.38	42.00	-0.13	0.28	0.38	1.70	0.6577
Luxembourg	2.35	9.34	54.48	-4.73	-2.22	-0.42	6.67	-0.3414
Hungary	0.55	1.65	55.94	0.41	0.54	-0.51	2.26	0.5457
Malta	0.46	14.76	47.97	0.65	-4.17	0.00	5.19	-0.0435
Netherlands	0.52	3.99	36.77	0.50	-0.30	0.71	1.46	0.7060
Austria	0.83	2.50	40.64	-0.38	0.23	0.47	1.81	0.6353
Poland	0.65	1.99	51.59	0.12	0.42	-0.24	2.09	0.5804
Portugal	0.55	2.25	59.04	0.40	0.32	-0.71	2.48	0.5011
Romania	0.39	1.13	85.70	0.86	0.73	-2.42	4.11	0.1728
Slovenia	0.93	2.77	40.15	-0.68	0.14	0.50	2.04	0.5900

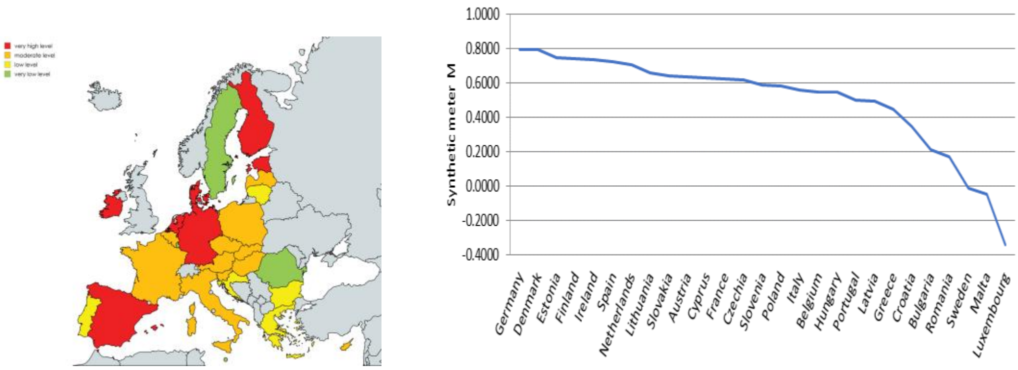
Slovakia	0.49	1.46	49.00	0.58	0.61	-0.07	1.78	0.6408
Finland	0.69	2.24	35.23	0.00	0.33	0.81	1.29	0.7396
Sweden	0.63	2.17	21.57	0.19	0.35	1.69	0.77	0.8447
Arithmetic average	0.69	3.15	47.91	0.00	0.00	0.00	2.3	0.537
Max	2.35	14.76	85.70	0.86	0.73	1.69	6.67	0.8447
Min	0.39	1.13	21.57	-4.73	-4.17	-2.42	0.77	-0.3414
Standard deviation	0	3	16	1	1	1	1	0
Volatility coefficient	51%	88%	33%	N/A	N/A	N/A	N/A	50%

Source: *Own study.*

The analysis of diagnostic variables related to the negative effects of transport made it possible to identify European Union countries with both the highest and lowest levels of these adverse phenomena. The synthetic indicators, calculated on the basis of previously normalized data, allowed for a comprehensive assessment of the degree of diversity of the studied areas in ecological and social terms.

The results obtained were used to develop a ranking of EU countries in terms of the severity of the negative effects of transport. This ranking shows clear differences between Member States and allows for the identification of leaders and countries requiring intensification of measures to reduce the impact of transport on the environment and public health. In addition, for a better illustration of the spatial diversity of the ecological and social impacts of mobility development (Figure 1, Table 3).

Figure 1. *Ranking of EU countries in terms of generating negative transport impacts*



Source: *Own study.*

Based on standardized data, a synthetic indicator of the eco-social impact of transport in the EU-27 countries was constructed using taxonomic procedures. The indicator integrated three dimensions: greenhouse gas emissions, energy consumption, and road traffic fatalities. By categorizing the indicator values, the countries were divided into four development classes:

- Class I (highest indicator values: relatively lowest impacts):
  Germany (0.7963), Denmark (0.7961), Estonia (0.7447), Finland (0.7396), Ireland (0.7346), Spain (0.7222), Netherlands (0.7060).
- Class II (moderate burdens):
  Lithuania (0.6577), Slovakia (0.6408), Austria (0.6353), Cyprus (0.6304), France (0.6222), Czech Republic (0.6185), Slovenia (0.5900), Poland (0.5804), Italy (0.5612), Belgium (0.5498), Hungary (0.5457).
- Class III (higher burdens requiring urgent intervention):
  Portugal (0.5011), Latvia (0.4916), Greece (0.4467), Croatia (0.3454), Bulgaria (0.2104).
- Class IV (lowest values of the indicator: most serious burdens):

Romania (0.1728), Sweden (–0.0126), Malta (–0.0435), Luxembourg (–0.3414).

Table 3. *Assessment of EU countries in terms of the negative effects of transport*

Country	Synthetic meter M	Enviromental Level*	Country	Synthetic meter M	Enviromental Level*	Country	Synthetic meter M	Enviromental Level*	Country	Synthetic meter M	Enviromental Level*
Germany	0.796	very high	Lithuania	0.66	moderate	Portugal	0.501	low	Romania	0.17	
Denmark	0.796		Slovakia	0.64		Latvia	0.49		Sweden	0.00	very low
Estonia	0.745		Austria	0.64		Greece	0.45		Malta	0.00	
Finland	0.74		Cyprus	0.63		Croatia	0.35		Luxembourg	-0.3	
Ireland	0.73		France	0.62		Bulgaria	0.21				
Spain	0.72		Czechia	0.62							
Netherlands	0.71		Slovenia	0.59							
			Poland	0.58							
			Italy	0.56							
			Belgium	0.55							
			Hungary	0.55							

Note: **Level of negative environmental and social effects of transport.*
Source: *Own study.*

The resulting variation indicates the varying degrees of advancement of transport policies and the effects of the low-carbon and road safety strategies implemented. The results can serve as a basis for formulating targeted policy recommendations and further comparative analyses.

5. Discussion

Based on a multidimensional comparative analysis of the negative effects of transport in the EU-27 countries, it was possible to identify countries where the impact of the transport sector on the environment and public health is relatively least severe.

Three diagnostic dimensions were used to construct the synthetic indicator: greenhouse gas emissions, final energy consumption in transport, and the number of fatalities in road accidents – adjusted for population size, which made it possible to obtain a measure of the relative socio-environmental burden.

The results showed significant differences between EU Member States in terms of the scale of the adverse effects of transport. The highest values of the synthetic indicator – interpreted as the most favorable level of burden – were recorded in Germany, Denmark, Estonia, and Finland.

The high ranking was interpreted as the result of the effective integration of energy efficiency, emission reduction, and road safety improvement policies, which may be linked to long-term investments in mobility transformation and extensive education and control programs.

The lowest synthetic indicators – indicating relatively higher social and environmental burdens – were recorded in Romania, Bulgaria, Luxembourg, and Malta. These countries were found to have a predominance of high-emission modes of transport, increased energy consumption in the sector, and unfavorable road accident statistics, suggesting significant deficits in transport management systems and requiring urgent corrective measures in the areas of safety and environmental pressure reduction.

The analysis highlighted profound disparities in the socio-environmental impacts of transport, resulting from both the level of economic development and the diversity of approaches to transport policy and the quality of implementation of sustainable development strategies.

High index values can be seen as evidence of conscious and consistent integration of environmental, health, and social objectives, while low values signal the need to intensify reforms and increase resource commitment where the burdens are most significant.

These conclusions point to the need to continue monitoring the negative effects of transport and to improve analytical tools for a comprehensive assessment of the impact of mobility on quality of life. Particular emphasis should be placed on further reducing emissions, increasing energy efficiency, and raising road safety standards.

The achievement of these objectives is a prerequisite for improving the functioning of the transport system and an instrument for protecting public health and environmental resources.

The results of such a multidimensional analysis – from the perspective of EU and national policy – can serve as a basis for formulating sustainable transport strategies that are adapted to local conditions and at the same time consistent with the objectives of European integration.

The debate should focus in particular on the principles of promoting best practices, strengthening cross-border cooperation, and developing uniform assessment and monitoring tools, which will reduce inequalities and increase the sustainability of the transport sector across the EU.

6. Limitations of the Study

The limitations of the study can be summarized as follows:
(1) limited number of indicators – only greenhouse gas emissions, energy consumption, and fatalities were taken into account, while noise, other pollutants, and transport accessibility were omitted,

(2) subjective selection of weights and aggregation methods – the assumptions of the linear model may have influenced the values of the synthetic indicator, while other approaches (e.g., principal component analysis) would have yielded different results,

(3) static approach – a one-year analysis does not allow for an assessment of changes over time or the effectiveness of transport policies,

(4) varying availability and quality of data – methodological differences between EU countries may distort comparisons,

(5) spatial aggregation at the national level – ignores internal regional diversity and local “hotspots” of negative transport impacts,

(6) omission of contextual factors – failure to take into account political, economic, and cultural conditions limits the explanation of the reasons for differences between countries,

(7) assumption of linear relationships – the proportional impact of each variable does not reflect real non-linear effects (e.g., road accident thresholds),

(8) lack of qualitative verification – relying solely on quantitative data makes it difficult to interpret the mechanisms underlying the observed phenomena.

7. Conclusions

The aim of the publication was to determine synthetic indicators for assessing the intensity of the adverse impacts of the transport sector in the Member States of the European Union, which was achieved through the harmonization of metrics, a balanced selection of weights, and the resulting synthetic indicator, which reflects the multidimensional nature of transport development in the EU-27, taking into account complex socio-economic and environmental conditions.

This measure allows for a comprehensive comparison of countries, identification of areas requiring intervention, and determination of directions for further improvement of transport policies.

The preliminary list of diagnostic features developed for this study included indicators in the areas of energy consumption (X1), greenhouse gas emissions (X2), and the number of fatalities in road accidents (X3), which were selected on the basis of their key importance in the context of analyzing the negative effects of transport development.

These indicators reflect important environmental and social aspects related to mobility, allowing for a comprehensive assessment of the impact of transport on public health, safety, and the environment.

The process of normalizing the variables was carried out using the standardization, ratio transformation, or unitarization method, with standardization being used in this study in accordance with the formula of the ratio of the difference between the value of the j-th feature in the i-th object and the arithmetic mean of the standard deviation, obtaining a matrix of normalized values necessary for further aggregation in the linear ordering analysis.

Next, a procedure for normalizing diagnostic variables was performed, consisting of transforming raw values to a common reference scale. Normalization was carried out to ensure data comparability and an objective assessment of the level of environmental and social pressure caused by the transport sector. After normalizing the diagnostic variables, a linear ordering stage was carried out, using the so-called development pattern method.

The results of the analysis indicate significant differences between EU countries in terms of the scale of negative effects associated with the functioning of the transport sector. The highest values of the indicator – interpreted as the most favorable level – were achieved by, among others, Germany, Denmark, Estonia, and Finland.

These countries are distinguished by relatively low emissions, rational energy consumption in transport, and a favorable road safety balance, which may indicate high systemic efficiency and the effectiveness of public policies. Their results may be the effect of many years of investment in the transformation of the transport sector, the development of sustainable mobility, as well as effective education and control in the field of road safety.

The lowest values of the indicator – indicating a higher socio-ecological burden per capita – were recorded in Romania, Bulgaria, Luxembourg, and Malta. These countries have a higher share of high-emission modes of transport, higher energy intensity, and unfavorable statistics on fatal road accidents. This points to significant gaps in transport management systems that require urgent corrective action to improve safety, energy efficiency, and reduce environmental pressure.

The analysis reveals profound disparities in the level of socio-environmental impacts of transport between EU countries. These differences result not only from the level of economic development, but also from different approaches to transport policy and the quality of implementation of sustainable development strategies. High values of the index can be seen as the result of the conscious integration of environmental, health, and social objectives into public policies, while low values signal the need to intensify reforms and increase spending in critical areas.

The further direction of research is considered to be the analysis of the dynamics of changes in the synthetic indicator over time, which will enable the assessment of the effectiveness of the reforms introduced and the identification of the factors with the greatest impact on improving the situation.

The scope of the analysis should be expanded to include internal diversity within Member States and additional variables, such as the availability of public transport, the structure of the vehicle fleet, and the intensity of freight transport, which will allow for more precise policy and practical recommendations.

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